

Docket No.: KC 19,065.1

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE  
APPLICATION FOR UNITED STATES LETTERS OF PATENT**

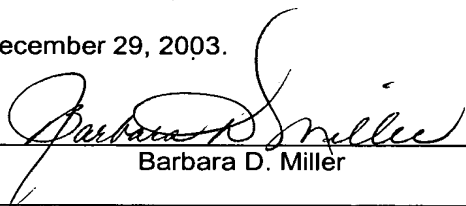
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**ABSORBENT ARTICLE FEATURING PHOTOLUMINOUS GRAPHICS**

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## **ABSORBENT ARTICLE FEATURING PHOTOLUMINOUS GRAPHICS**

### **CROSS REFERENCE TO RELATED APPLICATIONS**

[0001] This application is a continuation-in-part of application serial number 10/618,030 entitled "Substrate With Graphic Thereon" and filed in the U.S. Patent and Trademark Office on July 11, 2003. The entirety of application serial number 10/618,030 is hereby incorporated by reference.

### **FIELD OF THE INVENTION**

[0002] This invention relates generally to absorbent articles such as training pants, diapers, feminine hygiene products, incontinence garments and the like, and more particularly to such articles having photoluminous graphics thereon.

### **BACKGROUND OF THE INVENTION**

[0003] Absorbent articles such as diapers, training pants, incontinence garments, and the like often include a liquid-impermeable outercover, an absorbent body, and in some instances, graphics disposed on the exterior surface of the outercover. The graphics may provide a decorative feature, and particularly when used in connection with children's training pants, may be used to make the pants appear similar to conventional underwear. Further, the graphics may also be used to encourage training and/or be used to make the training experience more enjoyable and a generally positive experience. For example, the graphics may be used to allow the caregiver to interact with the wearer in the training setting.

[0004] Accordingly, the graphics may take various forms, such as the form of a character, object and/or alphanumeric (e.g., numbers, words, phrases, instructions, etc.), and the like. Moreover, at least some of the graphics may be configured to be capable of

being visible in low light conditions, including the dark, to further enhance the aesthetic appearance and usefulness of the article.

[0005] Nonetheless, such graphics, in certain circumstances, may not be completely effective. That is, in certain arrangements, particularly when such graphics are  
5 relatively small in size, the graphics may not be sufficiently visible in low light conditions. Further, the graphics may be sufficiently visible in low light conditions, but may be relatively amorphous and difficult to discern as a particular shape or object.

[0006] There is need, therefore, to provide graphics that are sufficiently visible in low light conditions. Moreover, there is a need to provide such graphics such that the  
10 depicted object is readily discernable by the wearer and/or caregiver to maximize the effectiveness of the graphic.

#### SUMMARY OF THE INVENTION

[0007] In one aspect, the present invention is directed to an absorbent article  
15 including an outercover defining an interior surface and an exterior surface opposite the interior surface. The absorbent article also includes an absorbent body disposed on the interior surface, at least one non-photoluminescent graphic disposed on the outercover, and at least one photoluminescent graphic disposed on the outercover. The at least one photoluminescent graphic defines a photoluminescent graphic area that is at least 10  
20 square cm and has a glow intensity of at least 0.5 lux at 60 seconds as determined by a Glow Intensity Test set forth herein.

[0008] In another aspect, the present invention is directed to an absorbent article including an outercover defining an interior surface and an exterior surface opposite the interior surface. The absorbent article also includes an absorbent body disposed on  
25 the interior surface, a plurality of non-photoluminescent graphics disposed on the outercover where the at least one non-photoluminescent graphics define a graphic theme,

and at least one photoluminescent graphic disposed on the outercover where the at least one photoluminescent graphic is related to the graphic theme.

[0009] In general, an article according to another aspect of the present invention is directed to an absorbent article including an outercover defining an interior surface, and an exterior surface opposite the interior surface. The absorbent article also includes an absorbent body disposed on the interior surface, a plurality of non-photoluminescent graphics disposed on the outercover. The plurality of non-photoluminescent graphics define a graphic theme. The absorbent article also includes at least one photoluminescent graphic disposed on the outercover. The at least one photoluminescent graphic defines a photoluminescent graphic area that is at least 10 square cm and has a glow intensity of at least 0.5 lux at 60 seconds as determined by a Glow Intensity Test set forth herein and is related to the graphic theme.

[0010] The above-mentioned and other aspects of the present invention will become more apparent, and the invention itself will be better understood by reference to the drawings and the following description of the drawings.

#### BRIEF DESCRIPTION OF THE DRAWINGS

[0011] Figure 1 representatively illustrates a side view of a pair of training pants with a mechanical fastening system of the pants shown fastened on one side of the training pants and unfastened on the other side of the training pants;

[0012] Figure 2 representatively illustrates a plan view of a pair of training pants similar to those illustrated in Figure 1 in an unfastened, stretched and laid flat condition, and showing the surface of the training pants that faces away from the wearer;

[0013] Figure 3 representatively illustrates a plan view similar to Figure 2, but showing the surface of the training pants that faces the wearer when worn, and with portions cut away to show underlying features;

[0014] Figure 4 representatively illustrates a plan view similar to Fig. 2 with one aspect of a graphic of the present invention applied to the pants;

[0015] Figure 5 representatively illustrates a plan view similar to Fig. 2 with another aspect of a graphic of the present invention applied to the pants;

5 [0016] Figure 6 representatively illustrates a plan view similar to Fig. 2 with yet another aspect of a graphic of the present invention applied to the pants;

[0017] Figure 7 representatively illustrates a plan view similar to Fig. 2 with yet another aspect of a graphic of the present invention applied to the pants; and

10 [0018] Figure 8 representatively illustrates a plan view similar to Fig. 2 with still yet another aspect of a graphic of the present invention applied to the pants.

[0019] Corresponding reference characters indicate corresponding parts throughout the drawings.

#### DETAILED DESCRIPTION

15 [0020] Referring now to the drawings and in particular to Fig. 1, a disposable article in the form of children's toilet training pants is indicated in its entirety by the reference numeral 20. The article may or may not be absorbent, which generally refers to absorbent articles that may be placed against or in proximity to the body of the wearer to absorb and/or retain various liquid waste discharged from the body. The term

20 "disposable" as used herein refers to articles that are intended to be discarded after a limited period of use instead of being laundered or otherwise restored for reuse. It is understood that the present invention is suitable for use with various other articles such as diapers, feminine hygiene products, incontinence products, medical articles such as medical garments, surgical pads and bandages, other personal care or health care

25 garments, apparel for institutional, industrial or consumer use, and the like without departing from the scope of the present invention.

[0021] By way of illustration only, training pants suitable for use with the present invention and various materials and methods for constructing the training pants are disclosed in PCT Patent Application WO 00/37009 published June 29, 2000 by A. Fletcher et al; U.S. Patent 4,940,464 issued July 10, 1990 to Van Gompel et al.; U.S. Patent 5,766,389 issued June 16, 1998 to Brandon et al.; and U.S. Patent 6,645,190 issued November 11, 2003 to Olson et al., which are incorporated herein by reference in their entirety to the extent they are consistent (i.e., not in conflict) herewith.

[0022] The training pants 20 is illustrated in Fig. 1 in a partially fastened condition and includes a front waist region 22, a back waist region 24, a crotch region 26 interconnecting the front and back waist regions, an inner surface 28 configured for a facing relationship with the wearer, and an outer surface 30 opposite the inner surface. With additional reference to Figs. 2 and 3, the training pants 20 also has a pair of laterally opposite side edges 36 and a pair of longitudinally opposite waist edges, respectively designated front waist edge 38 and back waist edge 39.

[0023] The illustrated pants 20 includes a central absorbent assembly, generally indicated at 32, which when laid flat can be rectangular or any other desired shape, a pair of laterally opposite front side panels 34 extending outward therefrom at the front waist region 22 and a pair of laterally opposite back side panels 134 extending outward therefrom at the back waist region 24. The absorbent assembly 32 and side panels 34, 134 may comprise two or more separate elements, as representatively illustrated in Fig. 1, or be integrally formed. The central absorbent assembly 32 of the illustrated aspect includes an outercover 40, a bodyside liner 42 (Figs. 1 and 3) connected to the outercover in a superposed relation, an absorbent body 44 (Fig. 3) disposed between the outercover 40 and the bodyside liner 42, and a pair of containment flaps 46 (Fig. 3). The central absorbent assembly also has opposite ends 45 which can form portions of the front and back waist edges 38 and 39, and opposite side edges 47 which can form portions of the side edges 36 of the training pants 20 (Figs. 2 and 3). Integrally

formed side panels 34, 134 and absorbent assembly 32 would comprise at least some common materials, such as the bodyside liner 42, flap composite, outercover 40, other materials and/or combinations thereof, and could define a one-piece elastic, stretchable, or nonstretchable pants. For further reference, arrows 48 and 49 depict the orientation of the longitudinal axis and the transverse or lateral axis, respectively, of the training pants 20.

[0024] With the training pants 20 in the fastened position as partially illustrated in Fig. 1, the front and back side panels 34, 134 are connected together by a fastening system 80 to define a three-dimensional pants configuration having a waist opening 50 and a pair of leg openings 52. The front waist region 22 comprises the portion of the training pants 20 which, when worn, is positioned on the front of the wearer while the back waist region 24 comprises the portion of the training pants which is positioned on the back of the wearer. The crotch region 26 of the training pants 20 comprises the portion of the training pants 20 which is positioned between the legs of the wearer and covers the lower torso of the wearer. The front and back side panels 34 and 134 comprise the portions of the training pants 20 which, when worn, are positioned on the hips of the wearer. The waist edges 38 and 39 of the training pants 20 are configured to encircle the waist of the wearer and together define the waist opening 50 (Fig. 1). Portions of the side edges 36 in the crotch region 26 generally define the leg openings 52.

[0025] The central absorbent assembly 32 is configured to contain and/or absorb exudates discharged from the wearer. For example, the containment flaps 46 are configured to provide a barrier to the transverse flow of body exudates. A flap elastic member 53 (Fig. 3) can be operatively joined with each containment flap 46 in any suitable manner as is well known in the art. The elasticized containment flaps 46 define a partially unattached edge which assumes an upright configuration in at least the crotch region 26 of the training pants 20 to form a seal against the wearer's body. The containment flaps 46 can be located along the side edges 36 of the pants 20, and can extend longitudinally

along the entire length of the absorbent assembly 32 or may extend only partially along the length of the absorbent assembly. Suitable constructions and arrangements for the containment flaps 46 are generally well known to those skilled in the art and are described in U.S. Patent 4,704,116 issued November 3, 1987 to Enloe, which is incorporated herein  
5 by reference in its entirety to the extent it is consistent (i.e., not in conflict) herewith.

[0026] To further enhance containment and/or absorption of body exudates, the training pants 20 also suitably includes a front waist elastic member 54 (Figs. 1 and 3), a rear waist elastic member 56, and leg elastic members 58, as are known to those skilled in the art. The waist elastic members 54 and 56 can be operatively joined to the  
10 outercover 40 and/or the bodyside liner 42 along the opposite waist edges 38 and 39, and can extend over part or all of the waist edges. The leg elastic members 58 can be operatively joined to the outercover 40 and/or the bodyside liner 42 along the opposite side edges 36 and positioned in the crotch region 26 of the training pants 20. The leg elastic members 58 can be longitudinally aligned along each side edge 47 of the  
15 absorbent assembly 32.

[0027] The flap elastic members 53, the waist elastic members 54 and 56, and the leg elastic members 58 can be formed of any suitable elastic material. As is well known to those skilled in the art, suitable elastic materials include sheets, strands or ribbons of natural rubber, synthetic rubber, or thermoplastic elastomeric polymers. The  
20 elastic materials can be stretched and adhered to a substrate, adhered to a gathered substrate, or adhered to a substrate and then elasticized or shrunk, for example with the application of heat, such that elastic retractive forces are imparted to the substrate. In one particular aspect, for example, the leg elastic members 58 comprise a plurality of dry-spun coalesced multifilament spandex elastomeric threads sold under the trade name LYCRA®  
25 and available from E. I. Du Pont de Nemours and Company, Wilmington, Delaware, U.S.A.



[0028] The outercover 40 defines an exterior surface corresponding to the outer surface 30 of the training pant and an opposite interior surface. The outercover 40 desirably comprises a material that is substantially liquid impermeable. The outercover 40 can be a single layer of liquid impermeable material, but desirably comprises a multi-layered laminate structure in which at least one of the layers is liquid impermeable. For instance, the outercover 40 can include a liquid permeable outer layer and a liquid impermeable inner layer that are suitably joined together by a laminate adhesive (not shown). Suitable laminate adhesives, which can be applied continuously or intermittently as beads, a spray, parallel swirls, or the like, can be obtained from Findley Adhesives, Inc., of Wauwatosa, Wisconsin, or from National Starch and Chemical Company, Bridgewater, New Jersey. The liquid permeable outer layer can be any suitable material and desirably one that provides a generally cloth-like texture. One example of such a material is a 20 gsm (grams per square meter) spunbond polypropylene nonwoven web. The outer layer can also be made of those materials of which liquid permeable bodyside liner 42 is made. While it is not a necessity for outer layer to be liquid permeable, it is desired that it provides a relatively cloth-like texture to the wearer.

[0029] The inner layer of the outercover 40 can be both liquid and vapor impermeable, or can be liquid impermeable and vapor permeable. The inner layer is desirably manufactured from a thin plastic film, although other flexible liquid impermeable materials can also be used. The inner layer, or the liquid impermeable outercover 40 when a single layer, prevents waste material from wetting articles, such as bedsheets and clothing, as well as the wearer and caregiver. A suitable liquid impermeable film for use as liquid impermeable inner layer, or a single layer liquid impermeable outercover 40, is a 0.025 millimeter (1.0 mil) polyethylene film commercially available from Edison Plastics Company of South Plainfield, New Jersey. If the outercover 40 is a single layer of material, it can be embossed and/or matte finished to provide a more cloth-like appearance. As earlier mentioned, the liquid impermeable material can permit vapors to

escape from the interior of the disposable absorbent article, while still preventing liquids from passing through the outercover 40. A suitable "breathable" material is composed of a microporous polymer film or a nonwoven fabric that has been coated or otherwise treated to impart a desired level of liquid impermeability. A suitable microporous film is a

5 PMP-1 film material commercially available from Mitsui Toatsu Chemicals, Inc., Tokyo, Japan, or an XKO-8044 polyolefin film commercially available from 3M Company, Minneapolis, Minnesota.

[0030] The liquid permeable bodyside liner 42 is illustrated as overlying the outercover 40 and absorbent body 44, and may but need not have the same dimensions

10 as the outercover 40. The bodyside liner 42 is desirably compliant, soft feeling, and non-irritating to the child's skin. Further, the bodyside liner 42 can be less hydrophilic than the absorbent body 44, to present a relatively dry surface to the wearer and permit liquid to readily penetrate through its thickness. Alternatively, the bodyside liner 42 can be more hydrophilic or can have essentially the same affinity for moisture as the absorbent body 44

15 to present a relatively wet surface to the wearer to increase the sensation of being wet. This wet sensation can be useful as a training aid. The hydrophilic/hydrophobic properties can be varied across the length, width and depth of the bodyside liner 42 and absorbent body 44 to achieve the desired wetness sensation or leakage performance.

[0031] The bodyside liner 42 can be manufactured from a wide selection of

20 web materials, such as synthetic fibers (for example, polyester or polypropylene fibers), natural fibers (for example, wood or cotton fibers), a combination of natural and synthetic fibers, porous foams, reticulated foams, apertured plastic films, or the like. Various woven and nonwoven fabrics can be used for the bodyside liner 42. For example, the bodyside liner can be composed of a meltblown or spunbonded web of polyolefin fibers. The

25 bodyside liner can also be a bonded-carded web composed of natural and/or synthetic fibers. The bodyside liner can be composed of a substantially hydrophobic material, and the hydrophobic material can, optionally, be treated with a surfactant or otherwise

processed to impart a desired level of wettability and hydrophilicity. For example, the material can be surface treated with about 0.45 weight percent of a surfactant mixture such as AHCOVEL N-62 from Hodgson Textile Chemicals of Mount Holly, North Carolina, U.S.A. The surfactant can be applied by any conventional means, such as spraying, printing, brush coating or the like. The surfactant can be applied to the entire bodyside liner 42 or can be selectively applied to particular sections of the bodyside liner, such as the medial section along the longitudinal center line.

[0032] A suitable liquid permeable bodyside liner 42 is a nonwoven bicomponent web having a basis weight of about 27 gsm. The nonwoven bicomponent can be a spunbond bicomponent web, or a bonded carded bicomponent web. Suitable bicomponent fibers include a polyethylene/polypropylene bicomponent fiber available from CHISSO Corporation, Osaka, Japan.

[0033] The absorbent body 44 (Fig. 3) can be positioned between the outercover 40 and the bodyside liner 42, which can be joined together by any suitable means such as adhesives, ultrasonic bonds, thermal bonds, or the like. In particular, the absorbent body 44 may be disposed on the outercover 40, for example, on the interior surface of the outercover 40. As used herein, the term "disposed on" and variations thereof are intended to mean that one element can be integral with another element, or that one element can be a separate structure bonded to or placed with or placed near another element.

[0034] The absorbent body 44 can be any structure which is generally compressible, conformable, non-irritating to the child's skin, and capable of absorbing and retaining liquids and certain body wastes, and may be manufactured in a wide variety of sizes and shapes, and from a wide variety of liquid absorbent materials commonly used in the art. For example, the absorbent body 44 can suitably comprise a matrix of hydrophilic fibers, such as a web of cellulosic fluff, mixed with particles of a high-absorbency material commonly known as superabsorbent material. In a particular aspect, the absorbent body

44 comprises a matrix of cellulosic fluff, such as wood pulp fluff, and superabsorbent hydrogel-forming particles. The wood pulp fluff can be exchanged with synthetic, polymeric, meltblown fibers or short cut homofil bicomponent synthetic fibers and natural fibers. The superabsorbent particles can be substantially homogeneously mixed with the hydrophilic fibers or can be nonuniformly mixed. The fluff and superabsorbent particles can also be selectively placed into desired zones of the absorbent body 44 to better contain and absorb body exudates. The concentration of the superabsorbent particles can also vary through the thickness of the absorbent body 44. Alternatively, the absorbent body 44 can comprise a laminate of fibrous webs and superabsorbent material or other suitable means of maintaining a superabsorbent material in a localized area.

[0035] Suitable superabsorbent materials can be selected from natural, synthetic, and modified natural polymers and materials. The superabsorbent materials can be inorganic materials, such as silica gels, or organic compounds, such as crosslinked polymers, for example, sodium neutralized polyacrylic acid. Suitable superabsorbent materials are available from various commercial vendors, such as BASF Aktiengesellschaft located in Ludwigshafen, Germany, and Stockhausen GmbH & Co. KG, Krefeld, Germany. Typically, a superabsorbent material is capable of absorbing at least about 10 times its weight in water, and suitably is capable of absorbing more than about 25 times its weight in water.

[0036] In one aspect, the absorbent body 44 comprises a blend of wood pulp fluff and superabsorbent material. One preferred type of pulp is identified with the trade designation CR1654, available from U.S. Alliance, Childersburg, Alabama, U.S.A., and is a bleached, highly absorbent sulfate wood pulp containing primarily soft wood fibers and about 16 percent hardwood fibers. As a general rule, the superabsorbent material is present in the absorbent body 44 in an amount of from 0 to about 90 weight percent based on total weight of the absorbent assembly. The absorbent body 44 may or may not be

wrapped or encompassed by a suitable tissue or nonwoven wrap that may help maintain the integrity and/or shape of the absorbent assembly.

[0037] The central absorbent assembly 32 can also incorporate other materials or components designed primarily to receive, temporarily store, and/or transport liquid along the mutually facing surface with the absorbent body 44, thereby maximizing the absorbent capacity of the absorbent assembly. One suitable additional component is commonly referred to as a surge layer (not shown) and comprises a material having a basis weight of about 50 to about 120 grams per square meter, and more particularly comprises a through-air-bonded-carded web of a homogenous blend of 60 percent 3 denier type T-256 bicomponent fiber comprising a polyester core/polyethylene sheath and 40 percent 6 denier type T-295 polyester fiber, both commercially available from Kosa Corporation of Salisbury, North Carolina, U.S.A.

[0038] As noted previously, the training pants 20 may have front and back side panels 34 and 134 disposed on each side of the absorbent assembly 32. The side panels 34, 134 can be permanently bonded along seams 66 to the central absorbent assembly 32 in the respective front and back waist regions 22 and 24. More particularly, as seen best in Figs. 2 and 3, the front side panels 34 can be permanently bonded to and extend transversely outward beyond the side edges 47 of the absorbent assembly 32 in the front waist region 22, and the back side panels 134 can be permanently bonded to and extend transversely outward beyond the side edges of the absorbent assembly in the back waist region 24. The side panels 34 and 134 may be bonded to the absorbent assembly 32 using attachment means known to those skilled in the art such as adhesive, thermal, pressure or ultrasonic bonding. Alternatively, the side panels 34 and 134 can be formed as an integral portion of a component of the absorbent assembly 32. For example, the side panels can comprise a generally wider portion of the outercover 40, the bodyside liner 42, and/or another component of the absorbent assembly 32. The front and back side

panels 34 and 134 can be permanently bonded together or be releasably connected with one another such as by the fastening system 80 of the illustrated aspect.

[0039] The front and back side panels 34, 134 each have an outer edge 68 spaced laterally from the seam 66, a leg end edge 70 disposed toward the longitudinal center of the training pants 20, and a waist end edge 72 disposed toward a longitudinal end of the training pants. The leg end edge 70 and waist end edge 72 extend from the side edges 47 of the absorbent assembly 32 to the outer edges 68. The leg end edges 70 of the side panels 34 and 134 form part of the side edges 36 of the training pants 20. The leg end edges 70 of the illustrated aspect are suitably curved and/or angled relative to the transverse axis 49 to provide a better fit around the wearer's legs. However, it is understood that only one of the leg end edges 70 may be curved or angled, such as the leg end edge of the back waist region 24, or neither of the leg end edges may be curved or angled, without departing from the scope of this invention. The waist end edges 72 are suitably parallel to the transverse axis 49. The waist end edges 72 of the front side panels 34 form part of the front waist edge 38 of the training pants 20, and the waist end edges 72 of the back side panels 134 form part of the back waist edge 39 of the pants.

[0040] The side panels 34, 134 suitably, although not necessarily, comprise an elastic material capable of stretching in a direction generally parallel to the transverse axis 49 of the training pants 20. Suitable elastic materials, as well as one process of incorporating elastic side panels into training pants, are described in the following U.S. Patents: 4,940,464 issued July 10, 1990 to Van Gompel et al.; 5,224,405 issued July 6, 1993 to Pohjola; 5,104,116 issued April 14, 1992 to Pohjola; and 5,046,272 issued September 10, 1991 to Vogt et al.; all of which are incorporated herein by reference in their entirety to the extent they are consistent (i.e., not in conflict) herewith. In particular aspects, the elastic material may comprise a stretch-thermal laminate (STL), a neck-bonded laminate (NBL), a reversibly necked laminate, or a stretch-bonded laminate (SBL) material. Methods of making such materials are well known to those skilled in the art and

described in U.S. Patent 4,663,220 issued May 5, 1987 to Wisneski et al.; U.S. Patent 5,226,992 issued July 13, 1993 to Morman; European Patent Application No. EP 0 217 032 published on April 8, 1987 in the name of Taylor et al.; and PCT application WO 01/88245 in the name of Welch et al.; all of which are incorporated herein by reference in  
5 their entirety to the extent they are consistent (i.e., not in conflict) herewith. Alternatively, the side panel material may comprise other woven or nonwoven materials, such as those described above as being suitable for the outercover 40 or bodyside liner 42; mechanically pre-strained composites; or stretchable but inelastic materials.

[0041] The fastening system 80 comprises laterally opposite first fastening  
10 components 82 adapted for refastenable engagement to corresponding second fastening components 84. In one aspect, a front or outer surface of each of the fastening components 82, 84 comprises a plurality of engaging elements. The engaging elements of the first fastening components 82 are adapted to repeatedly engage and disengage corresponding engaging elements of the second fastening components 84 to releasably  
15 secure the pants 20 in its three-dimensional configuration. A suitable fastening system is described in U.S. Patent 6,645,190 to Olson, et al., previously incorporated herein.

[0042] As representatively illustrated in Figure 1, when the fastening components 82, 84 are releasably engaged, the side edges 36 of the training pants 20 in the crotch region 26 define the leg openings 52, and the waist edges 38 and 39 including  
20 the waist end edges 72 of the side panels 34, 134 define the waist opening 50. For improved formation of the leg openings 52, it can be desirable in some aspects for the front side panels 34 to be longitudinally spaced from the back side panels 134 as illustrated in Figs. 2 and 3. For example, the front side panels 34 can be longitudinally spaced from the back side panels 134 by a distance equal to about 20 percent or greater,  
25 particularly from about 20 to about 60 percent, and more particularly from about 35 to about 50 percent, of the overall length of the pants 20.

[0043] When engaged, the fastening components 82, 84 of the illustrated aspect define refastenable engagement seams 88 (Fig. 1) which desirably although not necessarily extend substantially the entire distance between the waist opening 50 and the leg openings 52.

5 [0044] The training pants 20 of the various aspects of the present invention further include at least one graphic 61. For example, as representatively illustrated in Figs. 2, 4 – 8, the pants 20 include a plurality of graphics 61 disposed on the outercover 40. That is, the graphics 61 can be formed or applied directly or indirectly to a surface of the outercover 40, formed or applied between layers of a multiple layer outercover 40,  
10 formed or applied to a substrate that is placed with or near the outercover 40, formed or applied within a layer of the outercover 40 or another substrate, or other variations or combinations thereof. In particular aspects and as will be discussed in greater detail below, the graphics 61 can be printed, sprayed, or otherwise applied directly on a layer of the outercover 40. In other aspects, the graphics 61 can be applied to a layer placed with  
15 or near the outercover 61, such as a substrate associated with the absorbent body 44, including but not limited to tissue layers, liquid handling layers, absorbent layers, or the like.

[0045] The graphics 61 may include, but are not limited to, scenes, characters, animals, objects, alphanumerics such as numbers, letters, words, phrases and the like,  
20 that may capture the attention of the wearer and engage them to facilitate training; highlighting or emphasizing leg and waist openings 52, 50 in order to make product shaping more evident or visible to the user; highlighting or emphasizing areas of the product to simulate functional components such as elastic leg bands, elastic waistbands, simulated "fly openings" for boys, ruffles for girls; and highlighting areas of the product to  
25 change the appearance of the size of the product.

[0046] The graphics 61 of the present invention further include at least one non-photoluminescent graphic 62 (shown in solid lines in Figs. 2, 4-8), and at least one



photoluminescent graphic 64 (shown in phantom lines in Figs. 2, 4-8). As used herein, the term "photoluminescent" refers to the ability to luminesce as a result of absorbing electromagnetic radiation (e.g., light) from a source thereof and emitting electromagnetic radiation at a different wavelength than the source of electromagnetic radiation. For example, phosphorescent materials and fluorescent materials are both photoluminescent. As used herein, the term "phosphorescent" refers to the ability to phosphoresce, i.e., to absorb electromagnetic energy (e.g., light) from a source thereof and subsequently emit electromagnetic energy at a different wavelength than the source following removal of the electromagnetic energy source (e.g., in the absence of light). The term "non-photoluminescent" therefore refers to an inability to luminesce in response to exposure to electromagnetic energy.

[0047] Thus, the non-photoluminescent graphic 62 is generally visible under "normal" light conditions but becomes substantially less visible in low light conditions, and in particular in the absence of light. In contrast, upon exposure of the photoluminescent graphic to light sufficient to cause luminescence of the photoluminescent graphic, the photoluminescent graphic luminesces, i.e., emits electromagnetic radiation in low light conditions and/or upon the removal of light so that the photoluminescent graphic is visible or otherwise glows in low light and/or dark conditions. The term "visible" as used herein means visible to the human eye unaided by detecting, enhancing and/or magnifying devices.

[0048] Further, and as representatively illustrated in Fig. 2, 4-8, the photoluminescent graphic 64 may define a photoluminescent graphic outer perimeter 92 and a photoluminescent graphic interior 96, which is that area of the article 20 that is within the photoluminescent graphic outer perimeter 92. Moreover, as will be discussed in greater detail below, the photoluminescent graphic 64 may define a photoluminescent graphic length 74 and a photoluminescent graphic width 76.

[0049] The photoluminescent graphic 64 and the non-photoluminescent graphic 62 may be arranged on the article 20 in a variety of ways. For example, as representatively illustrated in Fig. 2, 4, 6-8 the non-photoluminescent graphic 62 may be in a substantially overlapping relationship with the photoluminescent graphic 64.

5 Alternatively, as representatively illustrated in Fig. 5 and 7, the non-photoluminescent graphic 62 and the photoluminescent graphic 64 may be independent, (i.e., separated) from each other. Still further, the non-photoluminescent graphic 62 and the photoluminescent graphic may be in a partially overlapping relationship (not shown).

[0050] As mentioned above, the graphics of the present invention can be a  
10 variety of configurations. For example, the photoluminescent graphic 64 may be a silhouette of at least a portion of the non-photoluminescent graphic 62. As used herein, a “silhouette” refers to a graphic that is a substantially solid or substantially filled in outline of an object. Thus, the photoluminescent graphic 64 may be a substantially solid (that is, nearly completely photoluminescent) silhouette (Figs. 4 and 6). Alternatively, as will be  
15 discussed in greater detail below, the photoluminescent silhouette may have certain portions be non-photoluminescent in order to provide a more distinct and distinguishable photoluminescent graphic 64 (Figs. 2, 6 and 8). In yet another alternative, the photoluminescent graphic 64 may be an outline of at least a portion of the non-photoluminescent graphic 62 (Figs. 5 and 7). In such an arrangement, in the absence of  
20 light or in low light, the photoluminescent graphic 64 may be readily discernable due to its relationship to the non-photoluminescent graphic 62.

[0051] The photoluminescent graphic 64 and the non-photoluminescent graphic 62, when overlapping, may be substantially co-extensive and superposed over each other (Figs. 4 and 6). Alternatively, photoluminescent graphic 64 and the non-  
25 photoluminescent graphic 62 may be in an overlapping relationship, but one may be larger than the other (Fig. 8). That is, the photoluminescent graphic outer perimeter 92 may be substantially equal to the non-photoluminescent graphic perimeter 93, or the

photoluminescent graphic outer perimeter 92 may be larger or smaller than the non-photoluminescent graphic perimeter 93. In yet another alternative, the photoluminescent and non-photoluminescent graphics 64 and 62 may overlap, but the non-photoluminescent 62 graphic may be a different object than the photoluminescent graphic 64 (not shown).

5           [0052] Similarly, when photoluminescent graphic 64 is independent of the non-photoluminescent graphics 62, it may still be a silhouette or an outline of one of the non-photoluminescent graphics 62 (Fig. 5). Alternatively, the photoluminescent graphic 62 may be a completely different object from the non-photoluminescent graphic 64 (Fig. 7).

10           [0053] In certain aspects, the non-photoluminescent graphics 62 of the present invention may also be configured to define a graphic theme. Thus, when the photoluminescent graphic 64 and the non-photoluminescent graphics 62 are different objects, the photoluminescent graphic may be related or unrelated to the graphic theme defined by the non-photoluminescent graphics 62. Suitably, the photoluminescent graphic 64 is related to the graphic theme. As such, the object that is depicted by the  
15 photoluminescent graphic 64 may be more readily discernable by the wearer or caregiver due to its association with the graphic theme. As can be readily appreciated, when photoluminescent graphic 64 is the substantially the same (for example, either an outline or silhouette) as the non-photoluminescent graphic 62, the photoluminescent graphic 62 is related to the theme of the non-photoluminescent graphic 64.

20           [0054] It should be noted that in order to establish a graphic theme, not every non-photoluminescent graphic 62 need be directly related to the graphic theme; however, it can be appreciated that to effectively establish a graphic theme, it is suitable to have at least half of the non-photoluminescent graphics 62 contribute to defining the graphic theme, more suitably the majority of the non-photoluminescent graphics 62 contribute to  
25 defining the graphic theme, and still more suitably substantially all of the non-photoluminescent graphics 62 contribute to defining the graphic theme. Similarly, it can be appreciated that where certain non-photoluminescent graphics 62 are not contributing

to defining the theme of the other non-photoluminescent graphics 62, it is most effective to at least have the non-contributing non-photoluminescent graphics 62 be neutral or non-opposing toward the graphic theme.

[0055] The non-photoluminescent graphics 62 may define a graphic theme

5 when the subject matter of one non-photoluminescent graphic 62 is the same as or is associated with the subject matter of another non-photoluminescent graphic 62. By way of example, two objects are considered related in subject matter where the images are identical; separately illustrate different sizes, shapes, colors of a common object; each illustrate one and the other of two objects that are commonly associated with one another,

10 such as the moon and stars, a body of water and water toys, a sandbox and suitable toys, a baseball bat and ball, a barn and animals, or the like; illustrate different items used in a particular activity, such as a sporting activity, a gardening activity or the like; jointly illustrate geometrically mating or engaging elements such as a triangle and a triangularly-shaped aperture, or two halves of a zipper; each illustrate one part of a multipart picture;

15 or the like. Similarly, two text messages are considered related in subject matter where the messages: are identical; jointly form a sentence, thought, or action such as "jump" and "up"; each refer to one and the other of two items that are commonly associated with one another, such as "bat" and "ball," "Big" and "Kid," "Big" and "Girl," or "Big" and "Boy"; jointly present a question and answer; or the like. Likewise, a text message and a pictorial

20 image are considered to be related in subject matter where the text names, defines or describes the image; or the like.

[0056] Conversely, and by way of illustration and without wishing to be limited to the enumerated examples, two objects are considered unrelated in subject matter where the images: illustrate items that are neither identical nor illustrate two objects that

25 are commonly associated with one another, such as an animal and a building block, a jump rope and a flower, a car and a star, a letter of the alphabet and a water toy, a fish and an apple, illustrate items used in unrelated activities, such as items used in sporting

activities and items used in gardening activities, or other unrelated activities; or the like.

Similarly, two text messages are considered unrelated in subject matter where the messages: are neither identical nor jointly form a sentence, thought, or action; refer to two items that are not commonly associated with one another, such as “ball” and “flower,”

- 5 “fish” and “pencil,” “car” and “ghost,” or other such unrelated words; or the like. Likewise, a text message and a pictorial image are considered to be unrelated in subject matter where the text does not name, define, describe or otherwise relate to the image.

[0057] As such, the graphic theme of the non-photoluminescent graphics 62 may, for example, be related by a unifying subject or common story line, which would be  
 10 generally known through books, movies, or other media sources. Moreover, as mentioned above, the photoluminescent graphic 64 may be related to the graphic theme to facilitate the identification of the photoluminescent graphic 64. In particular, and without wishing to be limited to the specific embodiments listed, suitable examples of a graphic theme with a related photoluminescent graphic 64 can include: the non-photoluminescent graphics 62  
 15 being a racquet, bat, glove, other sporting equipment or the like and the photoluminescent graphic 64 comprising balls, or being related sporting equipment or the like (Fig. 7); the non-photoluminescent graphic 62 being a butterfly net or the like and the photoluminescent graphics 64 comprising butterflies or the like; the non-photoluminescent graphic 62 being a fish, a boat or the like and the photoluminescent graphic 64 being a  
 20 boat, water toys or the like (Fig. 5); the non-photoluminescent graphic 62 being flowers, plants, gardening tools or the like and the photoluminescent graphic 64 comprising flowers or plants; the non-photoluminescent graphics 62 being a specific environment such as a barn, silo, tractor or the like and the photoluminescent graphic 64 comprising cows, chickens, sheep, or the like which are specifically adapted to the environment; the non-  
 25 photoluminescent graphic 62 being a telescope, stars, planets or the like and the photoluminescent graphic 64 being rockets, spaceships, or flying saucers or the like (Fig. 8).

[0058] In the various aspects of the present invention, the photoluminescent graphic 64 may advantageously be of a particular size. That is, the photoluminescent graphic 64 of the present invention may define a photoluminescent graphic area. The photoluminescent graphic area may be determined by multiplying the largest dimension of the photoluminescent graphic 64 in the lateral direction 49 (the photoluminescent graphic width 76) by the largest dimension of the photoluminescent graphic 64 in the longitudinal direction 48 (the photoluminescent graphic length 74). The photoluminescent graphic length and width 74 and 76 are representatively illustrated in Fig. 4. In one aspect, the photoluminescent graphic area may be at least 10 square cm. Alternatively, in another aspect, the photoluminescent – graphic may suitably be at least 20 square cm; more suitably at least 25 square cm; still more suitably at least 30 square cm; yet more suitably at least 40 square cm; and still yet more suitably at least 45 square cm. As such, when the photoluminescent graphic 64 defines a photoluminescent graphic area as described above, it is more readily discernable in low light by the wearer and the caregiver.

[0059] Similarly, in aspects where the photoluminescent graphic 64 is an outline of an object (Figs. 5 and 7) the photoluminescent graphic 64 may define an outline thickness 78 as illustrated in Figs. 5 and 7. The outline thickness 78 may be determined by measuring the narrowest distance between the photoluminescent graphic outline inner perimeter 90 and the photoluminescent graphic outer perimeter 92 at any given location along the photoluminescent graphic outer perimeter 92. Accordingly, in one aspect, at least a portion of the photoluminescent graphic outline thickness 78 may be at least 0.30 cm. Alternatively, in another aspect, the outline thickness 78 may suitably be at least 0.60 cm; more suitably may be at least 0.90 cm and still more suitably may be at least 1.20 cm. Accordingly, when the photoluminescent graphic 64 defines a photoluminescent graphic outline thickness 78 as described above, the photoluminescent graphic 64 may be more readily discernable in low light by the wearer and the caregiver.

[0060] The photoluminescent graphic 64 of the present invention may also include graphic attributes 94 (Figs. 2, 5 – 8). The graphic attributes 94 may be portions of the photoluminescent graphic 64 that assist the wearer or caregiver in recognizing the object depicted by the graphic 64 by adding a characteristic or feature to the photoluminescent graphic 64 that may otherwise be an outline or a silhouette of an object. That is, the graphic attribute 94 may represent a feature or element of the photoluminescent graphic 64 such as a detail or structural component. The graphic attributes 94 may be incorporated in the photoluminescent graphic 64 in various ways as necessary in order to assist the viewer in recognizing the object depicted by the graphic. For example, the graphic attribute may be located in the graphic interior 96 of the photoluminescent graphic 64. As representatively illustrated in Fig. 2, the photoluminescent graphic 64 may include graphic attributes in the form of eyes. Alternatively, as representatively illustrated in Fig. 6, the photoluminescent graphic may include graphic attributes 94 in the form of windows in a photoluminescent castle.

[0061] In particular aspects, the graphic attributes 94 may be a non-photoluminescent portion or portions within an otherwise completely photoluminescent graphic interior 96. For example, a photoluminescent graphic 64 may define a photoluminescent silhouette and may include graphic attributes 94 that are non-photoluminescent portions in the graphic interior 96 to indicate eyes (Fig. 2) in a person or animal, windows in a building, edifice, or the like (Figs. 6, 8), a smiling mouth in a face, or the like. Alternatively, the graphic attribute 94 may represent a detail such as a wall or other structural component that may completely or partially separate a portion of the photoluminescent graphic 64 from another portion of the photoluminescent graphic 64. For example, a wall or turret may be indicated in a photoluminescent castle by way of a non-photoluminescent line passing through the castle.

[0062] Similarly, the graphic attributes 94 may be discrete photoluminescent portions within a non-photoluminescent portion of a photoluminescent graphic 64. For

example, the photoluminescent graphic 64 may be an outline of the object depicted, and thus defines a non-photoluminescent graphic interior 96. Accordingly, the graphic attributes may be photoluminescent portions within the graphic interior 96. As representatively illustrated in Fig. 5, the graphic attributes 94 may, in such a configuration, be photoluminescent portholes in the photoluminescent outline of a ship. Alternatively, the graphic attributes 94 may be photoluminescent threads within the photoluminescent outline of a ball (Fig. 7).

[0063] As mentioned above, the non-photoluminescent graphic and the photoluminescent graphic may be disposed on the outercover using a variety of methods. For example, the graphics 61 may suitably be disposed on the pants 20 by being imprinted thereon using a flexographic printing process. Flexographic printing is a conventional printing technique which uses flexible, raised rubber or photopolymer plates to carry an inked image to a substrate, such as the inner layer of the outercover 40 of the pants 20. As an example, flexographic printing apparatus are shown and/or described in U.S. Patent Nos. 5,458,590 (Schleinz et al.); 5,566,616 (Schleinz et al.); U.S. 2003/0019374A1 (Harte); and 4,896,600 (Rogge et al.). Moreover, suitable techniques for applying a photoluminescent graphic are described in U.S. Patent Application number 10/618030 filed July 11, 2003, and hereby incorporated by reference in its entirety to the extent that it is consistent (i.e., not in conflict) herewith.

[0064] Photoluminescent ink (broadly, photoluminescent material) suitable for use with flexographic printing to provide a photoluminescent graphic may include a photoluminescent substance and a solvent blend. For example, one suitable photoluminescent substance is strontium aluminate. Another suitable photoluminescent substance is zinc sulfide. The solvent blend is suitably the same as that described previously as suitable for preparing the non-phosphorescent ink. As an example, one suitable phosphorescent ink is available from Sun Chemical of Fort Lee, New Jersey, U.S.A. under the designation GlowPac.



[0065] It is understood that conventional printing techniques other than flexographic printing may be used to apply the graphics 61 of the present invention. For example, other suitable printing techniques include, without limitation, screen printing, rotogravure printing in which an engraved print roll is utilized, and ink jet printing in which  
5 nozzles spray ink droplets that are selectively deflected by an electrostatic charge onto a substrate.

#### Glow Intensity Test

[0066] The following Glow Intensity Test can be performed to determine the  
10 glow intensity, in terms of lux value, of a photoluminescent graphic of the present invention, such as on a substrate or an article incorporating the graphic.

[0067] Test equipment to be used for the Glow Intensity Test comprises a table having a flat table top of at least about 24 inches by about 24 inches. The table is covered by a black cloth. Two pair of flood lamps (or more as needed to obtain the required  
15 incident lux values) are positioned approximately 12 inches above opposite sides of the table and are pointed down toward the center of the table generally at an angle of about 45 degrees. The lamps should be no more than 24 inches apart. The lamps are incandescent Sylvania 150 watt flood lamps. The intensity of the flood lamps is controlled with a suitable voltage regulator to have an illumination of about 2080 lux (9.7 aperture  
20 reading) as determined by a flashmeter, such as is commercially available from Minolta as model designation Flashmeter IV, positioned approximately 5 cm above the center of the table top and facing directly up between the lights.

[0068] An image analysis system such as one available from Carl Zeiss, Inc. of Thornwood, New York, U.S.A. under model designation Zeiss KS400 Image Analysis  
25 System is used to capture and analyze an image of the sample during testing. The system as described is equipped with an Axiocam CCD camera (1,300 x 1,300 pixels full chip, 8 bit gray scale) using 4 x 4 binning (325 x 258 pixels) with a camera gain of 2 for an

integration time of 5 seconds. An attached Nikon 20mm lens (f2.8) provides an approximately 80 mm by 63 mm field of view. The camera is centrally positioned above the table at a height such that the overlapping region of the photoluminescent graphic on the sample comprises in the range of at least about 10% to about 30% of the 80 mm by 63 mm field of view of the camera.

[0069] To conduct the Glow Intensity Test, a sample, such as an article, or a cut portion thereof, having photoluminescent and non-photoluminescent regions is used. The sample may be of substantially any size as long as it can lie flat on the table top with each of the photoluminescent and non-photoluminescent regions of the article comprising in the range of at least 1% of the field of view of the camera, for example, at least 10% to 30%. This allows sufficient contrast between the glowing region and non-glowing region of the sample within the images captured by the camera.

[0070] In addition to containing at least 1% non-photoluminescent area, the sampling region should also contain at least one photoluminescent graphic. The photoluminescent graphic should be approximately centered within the field of view, where possible. Where the photoluminescent graphic exceeds the size of the field of view of the camera, the greatest possible amount of the photoluminescent graphic should be fit into the field of view, while still including the necessary amount of non-photoluminescent area. Any photoluminescent portions of the graphic outside the field of view of the camera should be masked or cropped.

[0071] The sample should be kept in a dark environment (e.g., below flashmeter sensitivity) for a minimum of five minutes prior to conducting the test. The sample is then laid flat on the table. If necessary to maintain the sample flat, a 1/8 inch glass plate sized larger than the portion of the sample within the field of view may be placed over the viewed portion of the sample. The flood lamps are then turned on so that the sample is exposed to the incident light from the lamps for a period of 10 minutes. The lux level of the flood lamp illumination should be determined using the flashmeter.

[0072] After the 10 minute period of exposure, the flood lamps are turned off and allowed to power down for a period of about 0.5 seconds. A timer is then started and data acquisition is initiated with a first image of the viewed portion of the sample being captured by the image analysis system at 0.01 seconds. A binary mask can be created from the first image, using the KS400 system automatic contrast enhancement, delineation (size: 10, thr: 3) and thresholding to discriminate the glowing portion of the image from the non-glowing portion of the image. Pixels at greater than or equal to 50% of the light intensity of the brightest pixel in the image should be classified as glowing, while all other pixels should be classified as non-glowing and should be masked. The mask is also used in processing all subsequent images captured of the particular sample being tested. Additional images are captured and analyzed every 10 seconds up to 280 seconds. Each image is captured over a five second period.

[0073] For each captured image, the mean glow intensity for the glowing region of the image and the mean glow intensity for the non-glowing region are calculated. This is done by determining the mean pixel intensity for all pixels classified as glowing (from the analysis of the first image), and the mean pixel intensity for all non-glowing pixels (again, as determined by the analysis of the first image). The mean glow intensity of the specimen is then adjusted by subtracting the mean glow intensity determined for the non-glowing region from the mean glow intensity determined for the glowing region (otherwise referred to as determining the glow intensity difference). With appropriate calibration of the camera using standard illuminants, as is known in the art, the calculated glow intensities can be converted to lux values.

[0074] The test should be repeated for each sample at least three times, with the results for each given timepoint averaged.

[0075] It is understood that where a non-woven web is laminated over the tested film, such as in the manner of the outercover 40 of the training pants 20 described

herein, the glow intensity may be less than that set forth in the above table depending on the construction of the non-woven web.

5       [0076]   In one aspect, the mean glow intensity photoluminescent graphic as determined by the Glow Intensity Test after 60 seconds may be 0.30 lux, can suitably be at least about 0.40 lux, more suitably at least about 0.50 lux, still more suitably at least about 0.75 lux and still yet more suitably at least about 0.95 lux. Photoluminescent graphics having such glow intensities are more readily visible to the wearer and the caregiver in low light. As such, the value of such graphics in the training process is thereby enhanced.

10       [0077]   As various changes could be made in the above constructions and methods, without departing from the scope of the invention, it is intended that all matter contained in the above description and shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

15       [0078]   When introducing elements of the invention or the preferred aspect(s) thereof, the articles "a", "an", "the" and "said" are intended to mean that there are one or more of the elements. The terms "comprising", "including" and "having" are intended to be inclusive and mean that there may be additional elements other than the listed elements.